AN EVALUATION OF SOME METHODS OF TEACHING ARITHMETIC TO MENTALLY RETARDED CHILDREN

MABEL TILLIS WUNDERLICH

AN EVALUATION OF SOME METHODS OF TEACHING ARITHMETIC TO MENTALLY RETARDED CHILDREN

MABEL TILLIS WUNDERLICH

Submitted in partial fulfillment of the requirements for the degree of Master of Arts in the Graduate School of Florida Southern College

1949

APPROVAL

Professor Doster C. Vincent, Advisor

Professor Edward L. Flemming, Co-Advisor

Reader

Date submitted to the Chairman
of the Graduate Committee

ACKNOWLEDGMENT

Acknowledgment is herewith made to Professor Doster C. Vincent for his untiring efforts in advising the writer of this thesis, and to Professor Edward L. Flemming, Co-Advisor, and Doctor Thomas J. Wagner who served as readers of this thesis.

TABLE OF CONTENTS

CHAPTER I

SETTING THE PROBLEM

The Problem

General Statement

It is the purpose of this investigation to evaluate the techniques of teaching abstract arithmetical concepts by means of concrete visual imagery to mentally retarded school children.

Specific Problems

1. To seek to determine the approximate upper limits of arithmetic instruction for mentally retarded children.

2. To determine the nature of the learning process of the mentally retarded.

3. To determine those computational skills that are regarded as essential.

4. To develop effective methods for individual instruction.

Definition of Terms

"Mentally Retarded Children" is understood to mean those children who have an intelligence quotient generally between fifty (50) and seventy-five (75).

"Special Class" refers to an instructional unit provided by the Florida State Department of Education to meet the individual needs of educable children with mental deviations.

CHAPTER I

GENERAL INTRODUCTION

The Problem

General Statement

It is the purpose of this investigation to evaluate the educational effectiveness of teaching mentally retarded children by means of concrete visual imagery to modify retarded school children.

Specific Problems

1. To test the hypothesis that exceptional children differ significantly from normal children in mentality.

2. To determine the nature of the learning process of the mentally retarded.

3. To determine those educational skills that are retarded or accelerated.

4. To develop effective methods for individual instruction.

Definition of Terms

"Mentally retarded children" is understood to mean those children who have an intelligence quotient generally between fifty (50) and seventy-five (75).

"Special class" refers to an instructional unit provided by the Florida State Department of Education to meet the individual needs of educable children with mental deficiency.

Delimitations

This investigation covers a Special Class for mentally retarded children set up for the Lakeland Area in September, 1948, in Lakeland, Florida.

Basic Assumptions

Considering the statistics of the White House Conference Report of 1931 that 2% of all children are mentally retarded, and recognizing the fact that mentally retarded children have limited powers of reasoning, imaginative projection, and abstract abilities, it is assumed that if the principles of democracy are to be applied in the educational system, some method of adjusting the curriculum to meet the needs of the mentally retarded children should be made.

Basic Hypothesis

An evaluation of the techniques of teaching arithmetic to mentally retarded children may lead to the formulation of a program of teaching arithmetic that will be beneficial to all teachers of mentally subnormal children in Florida.

Need for the Study

> "Mathematics is a definite part of living and culture. We have no right to deny any student the opportunity to see this side of human culture, nor dare we cut him loose from school without the necessary mathematical tools."[1]

School laws were amended in the State of Florida to per-

---

1. A. John Bartky, Mathematics Teacher, May 1948, p. 205.

[illegible]

[illegible]

[illegible]

mit expanded educational facilities or services to educable children with deviations of a physical, mental, or emotional nature. However, when the special class was set up in Lakeland, although there was an abundance of materials available for diagnostic, remedial, and individualized teaching in the field of reading, writing and spelling, no materials other than mimeographed sheets of fundamental problems were available for arithmetic. After spending six months in the search of publications and books, in the fields of education and psychology, treating the subject of mathematics, methods to be used in the teaching of arithmetic to the mental deviate have been conspicuous by its absence. In a careful perusal of The Mathematics Teacher from 1942 to date, only two short articles could be interpreted to have a meaning for this field. In Fernald's book Remedial Techniques in Basic School Subjects, of 349 pages, less than one page was used to present the subject of methods of teaching arithmetic to the defective child.

Incidence of the Problem

In September, 1948, a Special Class for mentally retarded children was set up for the Lakeland Area in Lakeland, Florida, with twenty-two children enrolled. Five had been excluded from public school because of their low mentality. Seventeen were attending regular school having been socially promoted so that the range of chronological age was from eleven years and nine months to seventeen years and five

months, and the grades from which they were taken ranged from the third through the eighth.

Historical Background of the Problem

About 1800, Itard, medical director of the National Institute for the Deaf and Dumb at Paris, made the first attempt to educate a feeble-minded child. After five years of effort, he gave it up as hopeless but did succeed in demonstrating the principle that even idiots can be taught over a broad horizontal range, given time and careful training, though they never reach very high on any vertical scale of ability. The democratic ideal that all children should have an opportunity to develop themselves drew attention to the unfortunate feeble-minded as well as to the more fortunate children. In the first half of the nineteenth century in France, Edouard Seguin, a pupil of Itard, was making a study of the learning processes of subnormal and deaf children. His work was an influence on Thomas H. Gallaudet, who helped establish a school for the deaf in Hartford, Connecticut, in 1817. The study of the feeble-minded also became a part of Gallaudet's work. The first state institution was the Massachusetts School for Idiots and Feeble-Minded Youth in 1851.

Public school provision for children of low I. Q. was delayed because of the lack of compulsory school-attendance. As long as the children were not compelled to attend, those of low I. Q. seldom continued long in school, and many never

sections, and the grades from which they were taken, ranged from the fifth through the eighth.

Disciplined Deficiency of the Disciple

Since 1899, Ithaca, mankind's creation of the National Institute for the Deaf and Dumb at Paris, with the first attempt to educate a feeble-minded child. Since five years of effort, he drew it as a necessary but ill-nursed in destructive the potential that ever fabric can be tempt over a broad horizontal range, given time and essential evolution, though they never reach very high on any vertical scale of ability. The deficiency idea that all children should have an opportunity to develop themselves down eliminate to the more fortunate multi-talented or well as to the more fortunate children. In the first half of the nineteenth century in Prance, Edouard Seguin, a pupil of Itard, was making a study of his learning processes of abnormal and deaf children. His work was an influence on Pierre P. Gallaudet, who helped establish a school for the deaf in Hartford, Connecticut, in 1817. The study of the feeble-minded also became a part of Gallaudet's work. The first public institution was the Massachusetts School for Idiots and Feeble-Minded Youth in 1851.

Public school provision for children of low I. Q. was delayed because of the lack of compulsory school-attendance. As long as the children were not compelled to attend, those of low I. Q. seldom continued long in school, and many never

started. As early as 1870, compulsory attendance laws had been passed, but it was not until after 1890 that provisions began to be made to enforce the legislation, and Providence, Rhode Island, started the special class in 1896.

During this nineteenth century,[2] the second most influential subject in elementary school was undoubtedly arithmetic, which received impetus principally from the disciplinary and practical aims. In the earliest decades the most common procedure in teaching arithmetic was for the teacher to write out or dictate the problems to the pupils, who tried to solve them by applying the appropriate rules, the teacher then correcting the answers. An important advance in teaching methods was made in 1851, when Warren Colburn published his Mental Arithmetic, which followed Pestalozzi's ideas of psychological and inductive organization of subject matter.

Dewey's[3] philosophy of education took the form of a restatement of the aims of education in the light of the rapid social changes that had taken place in American society in the nineteenth century. According to Dewey, education should start with the psychological nature of the individual child in social relationships with his fellow human beings. Dewey pointed out that modifications of

---

2. R. Freeman Butts, A Cultural History of Education, p. 504.
3. Ibid., p. 522.

---

5. G. Jerome Waite, A Political History of Manitoba, p. 20.
6. Ibid., p. 227.

methods and curriculum should consist in efforts to meet the needs of a new society. Accordingly the subject matter and methods of the school should be adapted to the child's needs.

As the twentieth century opened, paramount stress was laid upon the acquisition of knowledge and skills in the fundamental processes. Various reforms entered in, attempting to individualize instruction, such as the project method, unit plan, and activity movements. William H. Kilpatrick of Columbia University was the leading exponent of the experience curriculum, while Helen Parkhurst devised the contract plan at Dalton, Massachusetts, and Carleton Washburne instituted the unit plan at Winnetka, Illinois, all of which adjusted the speed of achievement to the abilities of the individual. Most educators were urging the expansion of the services of elementary schools to include more attention to such activities as child study and special treatment of exceptional children. Both World Wars and several depressions helped stimulate activities along these lines.

In 1930, there were 354 cities of 10,000 population and over, with special classes where programs of training that would materially assist the mental deviate in becoming self-supporting were followed. Mastery of the fundamentals in arithmetic has been sought by the method of repetition. According to Heck[4] methods have emphasized the use of

---

4. Arch O. Heck, The Education of Exceptional Children, p. 367.

concrete materials, and a plan of instruction that places great emphasis on repetition followed.

By 1948, the State of Florida had instructional units set up for the mentally retarded in thirteen counties with a total of forty-four units and a total enrollment of 595 white children and 82 Negro. In 1948, Polk County accepted the responsibility delegated to it by the permissive legislation enacted by the State in 1947, of providing an adapted program for the children of the county who need it. Eleven classes were set up at this time.

To date, according to the United States Bureau of Publications, as well as Dr. Elise Martens, Chief, Exceptional Children and Youth, U. S. Office of Education, Washington, D. C., nothing has been written concerning methods of teaching arithmetic to mentally retarded children except short references to it in books on general methods.

Procedure in Collecting Data

Mathematics magazines, journals in the field of education and especially in the field of exceptional children, and all current periodicals have been followed for suggestions applicable to the felt need. All available books on methods, philosophy and psychology in the school, public and college libraries have been reviewed to secure additional information and viewpoints. A visitation program to observe the methods used at each grade level of elementary school as well as other special classes in Polk and Hills-

borough County was carried out by the writer. A written plan of the daily procedure was kept on the actual experiences with the class since September, 1948, by the investigator.

Field work in a Settlement House in Nashville, Tennessee, while enrolled in Scarritt College for Christian Workers formulated a desire on the part of the writer to do further work with underprivileged children, and has provided stimulus for years to help those who especially need help.

Teaching Seventh Grade Arithmetic to six classes a day and remaining after school to give individual help to those who were deficient in arithmetical skills provided the basis for selective preparation for collecting and applying the needed materials.

Procedure in Treating Data

The felt need, that of formulating some method of teaching arithmetic to mentally retarded children, will be viewed in the large and expanded by opinions of educators. Specifically, methods tried with the special class in Lakeland will be presented and test results to validate beliefs will be included.

The specific problems will be satisfied by presenting the descriptive characteristics of the mentally retarded child, the nature of the learning process, the arithmetic essential for the mentally retarded, and the methods used to teach arithmetic to mentally retarded children.

CHAPTER II

THE CHARACTERISTICS OF THE MENTALLY RETARDED CHILD

> "Among all the groups of children for whom special education is provided, perhaps none needs to have its causes presented more clearly than does the group designated as children of low I. Q."[1]

This need has become acute because of the heterogeneous basis for selection and classification of the group, the methods varying from that of observation of the practical adaptability of children to social living, to the more definite divisions on the basis of intelligence tests, and the multiplicity of terminology used to designate the group after it was selected. In 1931, in the Report of the White House Conference,[2] new classifications were made giving the terminology "mental defective" to those with mental ages below half their chronological age, and "mentally retarded" to those with mental ages from one-half to three-fourths their chronological age. Ingram[3] used this classification for mentally retarded, listing the average as 67. Ingram also states that 2% of all children should be enrolled in special classes for the mentally retarded. Kirk[4] states

---

1. Arch O. Heck, Education of Exceptional Children, p. 342.

2. White House Conference on Child Health and Protection, 1933, Report of the Committee on Physically and Mentally Handicapped, p. 357.

3. C. P. Ingram, Education of the Slow-Learning Child, p. 419.

4. Samuel A. Kirk, Teaching Reading to Slow-Learning Children, pp. 1-2.

that any child who has an I. Q. below 80 and who is not progressing in school at the same rate as other children may be considered mentally retarded. He divides the group educable in the public school into two groups, designating those from 50 to 70 as those who with adequate training can become self-supporting, and who educationally may attain a level between the first and fourth grades. Those whose I. Q. is roughly between 70 and 80 may reach the eighth grade and are usually capable of self-support and frequently can compete with other members of our society. Martens[5] states that two to five per cent of the juvenile population can be considered retarded mentally; therefore in Lakeland, Florida, with a white school enrollment of 4,300 there are probably 86 or more mentally retarded.

Educating mentally retarded children requires keen insight into their characteristics. In many ways all children are alike. The variations when they appear are mainly a master of degree. All children crave praise and recognition and a sense of security. All children want to play and be happy, yet all have fears and worries, and have the same inquisitiveness about their origins. All develop from infants to maturity even if at a different rate and to a different level of maturity.

Also in many special ways, the characteristics of the

---

5. Elise H. Martens, A Guide to Curriculum Adjustment for Mentally Retarded Children, p. 7.

mentally retarded differ from those of normal children. In addition to the gross retardation in terms of mental age, Baker lists qualitative psychological ways in which they are backward:

> "They follow a tendency to stereotyped answers by repeating the same response to different questions; they lack powers of self-criticism; their powers of association are limited; they are unable to keep unusual instructions in mind, but return to traditional methods; they fail to detect errors and absurdities in statements and in common-place situations; they tend to have concrete abilities rather than abstract; they have limited powers of reasoning, visualization and similar mental traits."[6]

Baker, in discussing the nature of intelligence says:

> "Definitions have been formulated to describe intelligence from a practical point of view. Binet defined intelligence as the ability to take and maintain definite direction, as adaptability to new situations, and as ability to criticize one's own acts. Woodworth had a somewhat similar concept in retentivity, or the ability to use facts and activities already acquired, by ready adaptability to novel situations, by curiosity, interest in, and desire to know about things, and by persistence, or the trait of sticking to what is begun. These definitions emphasize adaptability to life situations which would include not only school learning but practical adjustment to neighborhood, and to social customs. In these fields of practical applications, Thorndike proposed three areas of intelligence: the first is abstract, or the ability to understand and manage ideas and symbols such as words, numbers, scientific principles and similar facts; the second is mechanical intelligence, or the ability to learn, understand and manage things and mechanisms; and the third is social intelligence, or the ability to manage people, and to act wisely in human relations."[7]

---

6. Harry J. Baker, Introduction to Exceptional Children, p. 258.

7. Ibid., p. 227.

Thorndike[8] lists three ways individuals differ in intelligence as level, or difficulty, area, or experience, and speed, or quickness of mental activity. The factor of level is important, for unless an individual does not develop into the higher levels, he is considered mentally retarded. However, the second factor of area offers the greatest opportunity for real challenge in educating the mentally retarded for a mentally retarded child with a level of eight or nine years may have an array of experiences and good adjustment to simple environment so that he can achieve to a degree of self-realization. The speed factor has little worth for the mentally retarded for the lack of speed is one definite characteristic.

It was once believed that mentally retarded children developed mentally as did normal children but stopped developing earlier.

Kirk[9] reviewing the experimentation of Kuhlmann and Moore stated that the mentally deficient child is retarded from the beginning and, if anything, gradually becomes more retarded. All studies and observations show that the mentally deficient learn more slowly and retain less than normal children. Kirk in answering the question as to how the mentally deficient compared in learning ability with normal children

---

8. E. L. Thorndike, The Measurement of Intelligence, pp. 1-36.

9. Samuel A. Kirk, Teaching Reading to Slow-Learning Children, p. 8.

of the same mental age showed that the learning ability of mentally retarded children was equal to that of normal children over a short period of time. Surveys over a longer period of time showed that their rate of learning was slower because their rate of mental growth is slower. A six-year-old child with a six-year mental age will grow one year mentally in one year's time. A twelve-year-old subnormal child with a six-year mental age will grow mentally only one-half year.

As a group, mentally retarded children are slightly inferior to the average in physical development[10] and show many deviations from the normal such as excessively large, or very small heads, crowded and poorly formed teech, peculiarly shaped ears, and crossed eyes, in addition to defects of tonsils, adenoids, and glands. Usually there are two or more abnormalities per child. Also since speech is closely related to intellectual functions, a marked retardation in speech is frequently found.

Baker[11] lists the causes and characteristics of mental retardation by types. Cretinism causes by hypothyroidism, or deficiency of thyroid, gives certain physical deviation such as short legs and arms, short stubby fingers, square body proportions, short neck, protuberant stomach, dwarfish

---

10. Harry J. Baker, Introduction to Exceptional Children, p. 261.

11. Ibid., pp. 262-266.

size and limited mental ability. Mongolism, a type caused by a failure to develop, often caused by exhaustion of the reproductive powers of one or both parents, resembles closely the Mongolian race, having an oblique slant to the eyes and scanty and wiry hair. Usually the mentality is very low and development very slow. Microcephalism, is the type when the brain is only about one-fourth of its usual weight at birth and fails to develop, hence the skull does not have to grow to its formal size. Hydrocephalism is caused by an excess of cerebrospinal fluid in the brain and total cranial area, which causes the skull to grow to an abnormal size. Head injury at birth, or cerebral anoxia caused by a lack of oxygen for the child at or during birth causes deterioration of the brain tissue. Diseases such as paralysis, meningitis, and even severe cases of childhood diseases such as measles causes a mental retardation if there is a destruction of the brain tissue. The major cause of mental retardation is heredity.

Personality and social maladjustments are important factors in determining the success or failure of mentally retarded children. As a group they are more susceptible to these disturbances than the average children. However, there is no reason to suppose that social incompetence is inevitable if proper adjustments are made.[12] They may de-

---

12. Luella Cole and John J. B. Morgan, Psychology of Childhood and Adolescence, p. 311.

also was [illegible] normal weight. Secondly, a large [illegible] [illegible] changes in [illegible], often caused by [illegible] of the [illegible] [illegible] of [illegible] with [illegible]. [illegible] closed, the [illegible] [illegible] [illegible] a [illegible] [illegible] of the [illegible] and [illegible]. Usually [illegible] [illegible] [illegible] [illegible]. [illegible] is the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] is [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] is [illegible] [illegible] [illegible] [illegible] the [illegible] [illegible] the [illegible] [illegible]. The [illegible] cause of mental retardation is heredity.

[illegible] of the [illegible] are important factors in determining the success or failure of mentally retarded children. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] children. [illegible], there is no reason to [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] are [illegible].[12] [illegible] [illegible] [illegible] -

---

12. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] of [illegible] [illegible] and [illegible], p. [illegible].

velop undesirable traits because too much is asked of them. They become accustomed to failure before they have a chance to succeed. They become disallusioned, unhappy, truculent, and sometimes delinquent. The teacher of mentally retarded children should instill in them, emotional attitudes and habits which will make moral citizens of them. If they become delinquent it is because of faulty training. Each child should be encouraged to develop any trait that will help him in his adjustment to life. For example, if a child can develop a responsiveness to people it will make a better impression. Cole and Morgan state:

> "On the moral side the inability to think in abstract terms is especially noticeable. The word 'amoral' has been coined to describe the condition of a person who behaves contrary to accepted moral standards, not intentionally, but because he is unable to grasp the underlying concepts. A child must achieve a mental age of twelve before he develops even elementary concepts such as pity, sympathy or other virtues, and a considerable higher mentality seems needed for an adequate understanding of generalized principles of behavior."[13]

Kirk[14] reviews a statistical study by Ackerson to show five ways mentally retarded children differ from mentally normal children:

(1) They are retarded in school.

(2) They are slower and duller in manner.

(3) They are over suggestible.

---

13. Ibid., p. 314.

14. Samuel A. Kirk, Teaching Reading to Slow-Learning Children, p. 12.

(4) They have preference for younger children as playmates, and

(5) They object to teasing by other children.

He states further that mental retardation is accompanied by personality deviations which if not caused by the mental defect are certainly the result of mental retardation.

CHAPTER III

OBJECTIVES OF ARITHMETIC INSTRUCTION FOR THE MENTALLY RETARDED

> "The problem is to teach these retarded children to know, and to behave, and to give them the necessary knowledge to succeed to the limit of their ability and social level, and to train them to social habits which will enable them to behave perhaps above the limit of their mental ability and social level."[1]

Serious consideration must be given to the curriculum best suited to the needs of the children of this class. The aim is to develop the child's mental capacities and the control of his emotions to the point of adequate social adjustment, and the curriculum must be set up to accomplish this. The first point of emphasis is what work these subnormals will eventually be able to do. They will not be able to enter the professions nor fill any of the complex positions of business. But according to statistics[2] they will be able to fill such positions as bricklayer, carpenter, electrician, sheet-metal worker, mechanic, barber, packing-house or canning-plant worker, fruit-picker, dairy or ice delivery-man, or farm worker for the boys, while the girls can be trained for housework, restaurant or canning plant work, or sewing, if under supervision and not required to

---

1. Special Education: The Handicapped and the Gifted, Committee on Special Classes, Section III, Education and Training, p. 446.

2. W. J. McIntosh, Follow-Up Study of One Thousand Non-Academic Boys, Journal of Exceptional Children, March 1949, p. 168.

[illegible]

do too difficult calculations.

McIntosh[3] states that records were kept on 52 men with I. Q.'s less than 60, who were gainfully employed with salaries ranging from $18.00 to $40.00 per week, and who had held the same jobs from two to nine years. In presenting various findings of the comparisons of the work records of men of low I. Q., it was found that emotional stability and personal drive had more to do with the amount of wages earned than the I. Q., and that both of these factors were amenable to change by the educational process.

All mentally retarded children should, if possible, learn to count money accurately and to tell time. All should be familiar with banks, writing checks, Post Offices, the general facts of savings, and have a knowledge of the fundamentals that will give them skill in solving life's problems which will confront them quantitatively. They should be taught to read and understand not only the minimum mathematical terminology, but also to read the "help wanted" advertisements, the "lost and found" column, and food and clothing advertisements. The formation of desirable habits in a social way are as important as the development of good health habits for the observance of general rules such as punctuality and regularity are essential in the business world.

---

3. Loc. cit.

It becomes necessary to break away from traditional courses of study with respect to subject matter and methods of instruction because it is not a question of preparing these children for high school but for life, and too, the interpretation of the life they are facing today. Learning activities should be based on those included from the kindergarten through the eighth grade but the upper level for actual work for most will probably be the fourth grade. However, the real differentiation consists fundamentally in difference of quality, not quantity of materials or skills. This cannot be achieved by the simple process of studying the standard curriculum more slowly, nor even in limiting the amount given. Subnormal children cannot acquire as much in quantity, or in as short a time as normal, but the need is even greater than this. Special methods of instruction and longer periods of time are needed but more than this, these children require instruction in a field which is entirely omitted from the standard course of study. Normal children are expected to acquire such information from their natural environment. Much that is self-evident to the normal children as a part of their home training must be taught from many aspects to retarded children and drilled upon until it becomes habitual. Also the time element enters in. The lower the degree or level of intelligence, the earlier should attention be centered on vocation for the

more habitual must all responses necessary for it be made. Also the less important do other responses become.

The formation of useful habits becomes the ultimate objective. The normal child can examine and criticize, and change as the occasion demands, but the retarded child can only apply what habits he has learned. Again in contrast to the normal, the subnormal must have more habitual responses than the normal for he will not be able to make new ones to suit the occasion. The retarded child can be prepared for independence if placed in a position where complicated reasoning is eleminated and a large number of habitual responses substituted.

The White House Conference Report[4] speaking of the extent of Education stated:

> "In order to accomplish the ideal of equality of opportunity for all children, opportunities must be provided for the mentally retarded to learn how to live completely and successfully on their own intelligence levels. Education must be given which will permit them to engage in the work of unskilled labor and live happily in the humblest group. Special abilities should be sought out and developed and as is the case with all types of handicapped children, the disability should be minimized, not stressed. As life in the world today demands some ability to read, write, and cipher, for successful living, these subjects should be taught, along with the development of manipulative skill, a sound body and good habits."

The maximum abilities of the child must be lined up with the minimum demands of society, and as closely as

---

4. White House Conference on Child Health and Protection, Report of the Committee on Physically and Mentally Handicapped, p. 478.

possible, an educational program set up that will be flexible and adjustable and serve as a path leading to a definite goal.

Actual practice in solving problems of daily life that are of concern to the pupil is a most valuable type of experience in democratic living. In most instances arithmetic makes a valuable contribution to these experiences. This happens when quantitative procedures are used in gathering data, keeping records, and showing essential relationships. The pupil will not only learn about arithmetic and its functions in daily life, but desirable personality traits and social characteristics will be developed. Attitudinal development is probably more important than informational materials. The realization of the need and value of receiving advice concerning investments from a banker or lawyer is more important than learning the routine facts of banking. The realization of the dangers of accepting advice from strangers, salesmen, or uninformed friends is more valuable than the factual knowledge of investments.

The objective then is to teach the mentally retarded child to the extent of his ability to learn rather than to attempt to make him conform to the normal child. He should be trained in so far as possible to take his place in the social order.

Kelley states:

"The general objectives of curriculum planning for the mentally retarded are the same as for

the normal since all individuals should be guided toward attainment of self-realization, acceptable human relations, economic efficiency, and civic responsibility. The selection of approaches would be the same for they would serve as pathways over which each would pass to achievement."[5]

---

5. Elizabeth Kelley, "Curriculum Planning for Exceptional Children," Journal of Exceptional Children, February 1948.

CHAPTER IV

METHODS OF TEACHING

Arithmetic is defined in the Bulletin[1] of the Florida State Department of Education as a system of quantitative thinking. The need for quantitative thinking arises early in the life of any child and increases with the demands of the social and physical environment. Breaking the quantitative idea down into mathematical concepts that are essential for a child or adult in the environment of today, four major divisions will appear: the concept of time, the concept of length, the concept of mass, and the concept of value relative to money or exchange.

These four abstract concepts must be presented in concrete form in order for the mentally retarded child to grasp them. The child whose mental age limit is five or six will never be able to do more than simple counting of objects actually before him.[2] Since he has no conception of number, he will have to count concrete objects actually touching them as he counts, and a peculiar fact is that he cannot add to a number already counted. For example, he may count three pennies, one, two, three, and if given two more, cannot continue four, five, but must return and count all

---

1. Florida State Department of Education, Arithmetic in the Elementary School, Bulletin No. 26., p. 6.

2. Grace M. Fernald, Remedial Techniques in Basic School Subjects, p. 267.

CHAPTER IV

CONCEPTS OF TIME AND SPACE

[illegible] is defined in the Bulletin[1] of the Florida State Department of Education as a process of quantitative thinking. The need for quantitative thinking enters into the life of any child and increases with the demands of the social and physical environment. Regarding the quantitative idea that children commonly encounter first are concepts of time and space. Time relates directly with space: the concepts of time, the concept of length. The concept of space, and the concept of value relative to money or economy.

These four important concepts must be presented in such a way in order for the mentally retarded child to grasp them. The child whose mental age limit is five or six will never be able to do more than simple counting of objects externally before him.[2] Since he has no conception of number, he will have to count numerous objects actually touching them as he counts, but a peculiar fact is that he must go a number already counted. Two examples, he may count three pennies, one, two, three, and if given the same amount additional time, five, but never can he count all

---

1. Florida State Department of Education, Bulletin No. [illegible] Elementary Edition, Bulletin No. VII, p. 5.

2. Grace M. Kennedy, Essential Instruments in Special Education, p. 157.

again, one, two, three, four, five. Therefore, concrete materials must be used in many forms--bottle caps, strips of colored paper, marbles, toothpicks, books, pencils, paper, desks, windows, doors, children, money, letters, stamps, oranges, and any and all the various things that the teacher and pupils can collect. The smaller materials may be placed on a counting table where the child may feel free to go and solve at his own speed any problem that confronts him. Soon such a feeling of security comes to the pupil who has met with success at the counting table that his best work will be accomplished there. Clark, Otis, and Hatton[3] suggest that for the normal child it is better for the teacher to picture pennies at the blackboard or designate them by symbols such as circles or crosses than to supply each pupil with real or play money. This is not as effective with the mentally retarded children as with using real or play money. They state that the representation is less distracting, and that the learner can better direct his thinking to the idea. Mentally retarded children need the sensory value of touch to help make the impressions of idea. In experimenting on this problem, it was found that if the symbols were written on the board, frequently the pupil would leave his seat to go to the board to touch each symbol to count them.

---

3. John R. Clark, Arthur S. Otis, and Carolyn Hatton, Primary Arithmetic Through Experience, p. 14.

The meaning of number impresses itself upon the child through group consciousness rather than "numberness." Groups of different objects become identified by a sameness of number so that the number relationship becomes a fact; finally, after repeated counting of concrete objects, abstract counting will become habitual whether it is understood or not.

Four techniques of developing learning were used: namely, the technique of auditory association, saying "three and two are five," the visual association of seeing three objects and two objects grouped, the imagery association by thinking of and recalling three objects and two objects, and the tactual association of touching two objects and three objects in a group. The hand kinesthetic method of tracing words and numbers, though very slow, proves effective. This method consists of having the child pronounce the word while he traces it with his finger or with a pencil, and then with eyes closed goes through the motion of tracing or writing it until he can reproduce it correctly. All of these methods, visual, auditory, imagery, and tactual, were used separately, and as a combination. Because each child is a different individual, no one method becomes best for all, but the combination of all with major emphasis on the tactual or kinesthetic seemed most effective.

The degree of deviation from the normal will determine the complexity of the process that can be developed in the

child. The final level of his development will probably be approximately that of the child whose actual age corresponds with his mental age. Thus as soon as the mental age is known two steps are necessary. First it is important to discover his arithmetic age or readiness for arithmetic for if he has not had instruction in arithmetic, or if he has not been able to profit by the type of instruction given, he may not be developed arithmetically to his mental age. Second, it is necessary to determine what facts he is capable of mastering at the mental age. Several readiness tests are available, but Brueckner's[4] readiness test seemed the most applicable to this locality. It consists of forty questions to be read by the teacher and answered or directions followed by the pupil. Fifteen must be answered to give a readiness level for the first grade, twenty-five for the second, etc.

Gradation level is ignored with the mentally retarded. Pupil need and the degree of the learning difficulty determines the content. The pupils are treated on an individual basis and assignments required to meet the individual needs are made for each as a daily assignment even though a unit including several pupils may be the interest motivating factor determining the assignments. Mental level or arithmetic level replaces the gradation level. Much research

---

4. Leo J. Brueckner and Foster E. Grossnickle, How to Make Arithmetic Meaningful, pp. 56-58.

has been done by Brueckner, Brownell, Osburne, The Committee of Seven under the direction of Washburne, and others to determine the grade placement of instruction of the number processes in the schools of the country. Brueckner reviewed all these available research findings and from them prepared a tentative arrangement of the subject matter of arithmetic according to mental level at which the available evidence showed that the major sections could be taught successfully to completion. Because this was most helpful in interpreting and choosing materials to be taught, his findings will be included.

RECOMMENDED GRADATION OF ARITHMETIC PROCESSES[5]

Mental Age	Whole Numbers	Fractions	Decimals
6-7	1. Counting 2. Identifying numbers to 200 3. Writing numbers to 100 4. Serial idea 5. Using numbers in activities of all kinds	1. Contacts in activity units and in simple measurements.	1. Tens as basis of number system
7-8	1. Reading and writing numbers to 1,000. 2. Concept development. 3. Addition and subtraction facts through six.	1. Recognizing fractional parts	1. Place value. 2. Zero as a place holder

5. Ibid., p. 90.

Vertical Axis	Title, Subtitle	Explanation	Footnote
6-7	1. Centralize 2. Telemetering readings to 200 3. Putting items in 100 4. Postal rates 5. Dating ownership in activities of all kinds	1. Obligations in activities have to do with the movement of items.	1. Tools of people of
7-8	1. Reading and writing numbers to 1,000. 2. Current Legislation. 3. Addition and subtraction facts through six.	1. Unemployment Compensation people	1. Please follow. 2. Look in a phone book

5. Ibid., p. 74.

Mental Age	Whole Numbers	Fractions	Decimals
8-9	1. Simple addition and subtraction facts. 2. Multiplication and division facts through fives. 3. Related even one-figure division.	1. Extending use of fractions in measurement. 2. Finding part of a number.	1. Computing with dollars and cents. 2. Reading money values.
9-10	1. Completion of all multiplication and division facts and processes. 2. Uneven division facts and processes. 3. One-figure multipliers and divisors.	1. Extending use and meaning of fractions. 2. Easy addition and subtraction by concrete means.	1. Computing with dollars and cents in all processes.
10-11	1. Two-figure multipliers. 2. Two-figure divisors.	1. Addition and subtraction of like fractions.	1. Addition and subtraction of decimals through hundreths.
11-12	1. Three and more figure multipliers. 2. Two-figure divisors when estimated quotient must be corrected.	1. All processes of fractions completed, including unlike fractions.	1. Multiplication and division begun.

Although the gradation by mental age was used as a guide, it could not be adopted as a standard because the mentally retarded child with a chronological age of sixteen and a mental age of eight who is gainfully employed, drives a car, has dates, and is largely his own guardian socially, needs much more in

arithmetic instruction than does an eight year old who may be starting the first study of organized arithmetic. He needs interpretation of facts and numbers from a child point of view but on an adult level of values. He has already experienced sums of money and has become distance and time conscious on an adult pattern. However, his attention and memory span is so short that those basic facts, already automatic with the normal child, are still vague abstractions to him.

No one method of teaching fundamentals will be best for all groups or for all in a group, but the approach which proved most effective was a combination of several methods. Addition and subtraction were taught together as a relationship. Two oranges and three oranges became a group of five, and if two were taken away, three were left. Then after repeated grouping of objects were rearranged until the number fact became real, three plus two became five and five minus or take away two was equal to three. In order to form the number awareness necessary, mimeographed pages of the 100 basic addition problems were used from the first. If the child had no conception of number grouping, he went to the counting table and counted out the number of concrete objects needed and formed the groups, and then counted the entire group. The first test responses were checked merely for errors or numbers missed. If five or less errors occurred on one test sheet, the errors were discussed and corrected

and another test sheet of the same basic 100 problems was worked. If more than five errors were made, individual help in actually grouping concrete objects was given with a practice test run, the errors corrected and then the test attempted again. Each test had to be perfect before it was left. If after a second attempt errors still occurred, a practice test was given with the instructor watching the pupil response and attempted response. Many faulty methods came to light. A common fault was for the pupil to choose one number, such as two, and proceed to search the entire 100 problems for the ones containing two. Thus from the 100 problems, 1 + 2, 2 + 2, 2 + 3, 4 + 2, etc. would be picked out and solved. This slowed the work and often confused the pupil so that he would omit many problems.

The same methods were used with subtraction. Since some pupils already had methods by which they had been taught, unless the methods were found to be incorrect, they were allowed to continue to use them though other methods were introduced so that a choice could be made if another proved more effective. In addition, 2 oranges and 2 oranges are four oranges became 2 and 2 are 4, then 2 plus 2 equals 4, and finally 2 + 2 = 4. Zero was explained as a place filler which carried no number value. Addition without carrying was introduced to challenge the interest and develop self-conficence. 13 plus 40 could be added as easily as the basic problems and gave such a feeling of accomplishment that

longer problems such as 8,425 plus 321 were used. When addition with carrying was given, the instructions were given to carry the tens number and write it at the top of the next column. In order to show the relationship between horizontal and vertical addition and also as a game for stimulating interest, problems such as the following were used with much success:

3 + 4 + 7 + 2 =
5 + 2 + 6 + 1 =
2 + 6 + 8 + 9 =
6 + 1 + 2 + 4 =

The answers to the horizontal sums were placed at the right, and the sums of the vertical columns at the bottom of each. Then the sum of the bottom horizontal problem should equal the sum of the vertical column of answers. Some drill was used to add to total of ten although all did not use this method.

Subtraction was taught by the "take away" method although one pupil used the additive method such as how much do you add to six to give ten. Borrowing in subtraction was taught by actually crossing out the number in the minuend and writing the new number to avoid confusion.

Multiplication and division were taught together with concrete objects representing various things. The High School band is familiar to all the pupils so buttons were used to form the lines of members of the band who march be-

tween halves at the football games. Ten buttons in a row and five rows showed the multiplication fact of fifty. The reverse of this to divide the fifty members of the band into ten rows showed the quotient five. As long as it was needed, the child went to the counting table and worked out the answers but in time most of the answers became habitual responses.

Individual charts were kept by each pupil so that he could make a record of his daily score. He was competing with himself and could progress as fast as he was able. Praise for the smallest attainment, public recognition of all achievement and comparison of the individual charts motivated the learning as did the fact that for the first time these children were doing something that they understood and could do, kept the interest high. Every paper that was worked was checked and added to the personal file of the pupil. Each pupil kept "My Arithmetic Notebook" in which he wrote down the facts that he learned and wanted to keep. Those who finally progressed to multiplication thus had their tables but not until they themselves worked them out and understood them. Because no workbook was found that answered the needs of the group, the practice materials were copied from Wheat,[5] Wilson, Stone and Dalrymple,[6]

---

5. Harry Grove Wheat, Psychology and Teaching of Arithmetic, pp. 302-303.

6. Guy M. Wilson, Mildred B. Stone, and Charles O. Dalrymple, Teaching the New Arithmetic, p. 403.

Greene and Jorgensen,[7] Osburne,[8] Brueckner,[9] or given by systematically listing the forty-five primary addition facts as:

1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9
2	2	2	2	2	2	2	2	
2	3	4	5	6	7	8	9	
3	3	3	3	3	3	3		
3	4	5	6	7	8	9		
4	4	4	4	4	4			
4	5	6	7	8	9			
5	5	5	5	5				
5	6	7	8	9				
6	6	6	6					
6	7	8	9					
7	7	7						
7	8	9						

Games furnished the drill and motivation for further study. Because it was impossible for all to keep facts in mind, the teacher would write a number on the board and ask for all the combinations that would add to give that answer. These would be written on the board. An example of this is 0 + 5, 1 + 4, 2 + 3, all give five. After several groupings had been written, the old game, "I am thinking of two numbers" would be played. The pupil calling the right combina-

---

7. Harry A. Greene, and Albert N. Jorgensen, The Use and Interpretation of Educational Tests, p. 241.

8. Worth J. Osburne, Corrective Arithmetic, pp. 155-168.

9. Leo J. Brueckner, Diagnostic and Remedial Arithmetic, p. 223.

tion was the leader of the next game. The same idea carried on through subtraction, multiplication, and division. Then flash cards were used to play various drill games. The most popular was baseball, where two sides were chosen, and the pitcher held up a flash card for the batter to add. If he give the wrong answer, or could not answer, it was a strike. If the bases were loaded, the different basemen were given a chance to answer, and if correct, could put out the men on the base. This proved to be so exciting that continuously pupils would ask for the flash cards to study the sums so that they might be better players. Bingo and dominoes and various versions of these games also helped build habitual responses. Games to build relationships were variations of the "I am thinking" game, such as "I am thinking of a number less than twenty-five." Each pupil could ask one question such as "Is it more than ten?" or "Is it less than eight?"

In order to test for meaning of symbols the author made up a type of problem that may not be ethical from a mathematical standpoint, but which was enjoyed and proved to be valuable from a meaningful point of view. It started with simple number such as:

$$4 + 8 \div 3 \times 5 = \_\_\_\_$$
$$\_\_\_\_ \div 5 \times 3 - 8 = 4$$

and developed to:

$$18{,}264 - 18{,}200 \div 8 + 2 \times 3 = \_\_\_\_$$
$$\_\_\_\_ \div 3 - 2 \times 8 + 18{,}200 = 18{,}264$$

Because of the variations in mental levels, few racing games were used. More games that allowed the child to compete with his own past record were used. One game that required quick thinking and automatic response was a card game of flash cards. Each child was given seven cards which he placed before him. Then the leader called a number. The first pupil to hold up the card with numbers the sum of which was the called number, turned in the card. If the response was incorrect, he not only kept the card but was also given another one. The winner was the first to get without cards.

Number recognition and meaning was promoted by introducing variations of charts and game devices on the matching idea. Inch cardboard or paper squares were cut and on the first twelve the numbers were written, one to each card. The next twelve contained the words one through twelve; the next set of twelve, either symbols from the typewriter or dots grouped from one to twelve; the next set, pictures cut from magazines or drawn; the next set, the Roman numerals, etc. The game was to arrange the numbers in order, then the word under each number, the symbol in its proper place, then the pictures, etc. Many variations were made and competition motivated the drill.

After the basic facts of the fundamentals were known this idea was carried further by using small squares each containing a number, or symbol such as +, -, ÷ , x, or = . With the numbers arranged across the top as the answers, problems could

be made under each which would give the answer at the top. For instance, under the number 9 such problems as 6 + 3, 3 x 3, 18 ÷ 2, and 11 - 2 would be placed.

Another similar game device that was used for drill consisted of one large cardboard divided into squares with a problem exemplifying one of the fundamental processes written in each square. The answers were written on small squares which could be placed over the proper square. These games were easily made and were arranged from the earliest combinations to the more difficult so that provision for each mental level was taken care of and yet all could participate at the same time so that group rivalry was present.

Although Fernald[10] states that it is useless to teach the defective child tricks in which numbers are used, the magic square, the trick of squaring numbers ending in 5 and some mathematical peculiarities such as:

3 x 37 = 111
6 x 37 = 222
9 x 37 = 333

. . .

27 x 37 = 999

or

1 x 9 + 2 = 11
12 x 9 + 3 = 111
123 x 9 + 4 = 1111

were used effectively.

Although methods used for teaching computational skills and quantitative relationships are presented separately, it does not mean that they were taught at different times, nor

---

10. Grace M. Fernald, Remedial Techniques in Basic School Subjects, p. 268.

that different methods were used. Rather, the same methods were used and the same procedures followed for both and they were taught as an integrated unit rather than as a separate fact. The procedure followed for both consisted of a test to determine how much the child knew, then those factors that were needed in the immediate environment or would be needed in the future presented in concrete form. The methods became not isolated drills but systematic ways of presenting ideas in a variety of familiar situations so that a recognition of quantitative relationships developed along with and in addition to computational skills. Methods became ideas of procedure through which a pupil not only learned to do what he was told to do, but also, because he first dealt with groups that were easily manageable, understood and saw the significance of what he was doing and how the skill would help him function in his daily life.

Time is an abstract concept but when it is written down as a daily schedule that determines the activities in which the child enters, it becomes a concrete time table. This was the introductory method of teaching time. School begins at 8:30. We study arithmetic from 8:30 to 9:30, dramatics from 9:30 to 10:30, reading from 10:30 to 11:30, and have lunch from 11:30 to 12:00. The classes are one hour in length but the lunch period is one-half hour or thirty minutes. With a stop watch one second was measured. Then the counting of sixty seconds to make a minute was practiced.

The time was announced on the hour and the records of sixty seconds passed were made. Cardboard play clocks were used and group participation in showing and telling time with the individual clocks used at times for all to set the hands to show a given time and at other times for one pupil to set his clock and have the class tell the time. The compass was used to draw clock faces and Roman numerals were written on some. The radio was discussed as a time piece and records of the hour of favorite radio programs were made. Each child made a schedule of what he did each hour of the twenty-four and the number of hours needed for sleep and the importance of the regularity of meal-time was discussed. Calenders were made and the date marked off to designate the passage of time. The date each day was written and such time relationships emphasized as how many days to the end of the month, some special day, or how many days since something of importance had occurred. Individual birthdays and the year of birth were referred to often and the date of today in relation to the birth of Christ was emphasized. On excursions downtown, dates on the buildings and monuments were read to determine the age of each. Time-tables from the railroad, bus and airlines were explained with emphasis on the necessity of regularity and punctuality. The importance of the sun in telling time led to the discussion of and methods of making sundials. Pictures of the sundial at the Bok Tower were used.

The concept of length is one that is easily interpreted into concrete form. The first experience was to use rulers and yardsticks to measure the heighth of each pupil. In this experience the words length, heighth, taller, shorter, and long were used and the heighths necessitated the introduction of inches, feet, and yards and their relationships. Then in arranging the classroom, various things were needed, for instance the class decided to place a small wire at the top of the blackboard along the front so that displays of art and other work could be clipped to the wire and thumb tacks would not be used. Measuring the length of the board was necessary and discussion of how much wire to buy formed a real problem.

Curiosity prompted the measurement of the room to determine its length and a steel tape was used for this so that the real meaning of feet extended into length was made in concrete form. Along with the discussion of time, each pupil was asked to count the blocks from his home to school and estimations as to the distance of each from school were made. The time-distance relationships were shown and oral problems were used, such as, Johnny lives ten blocks from school and can walk one block in two minutes. How long will he have to leave home to arrive at school ten minutes before school starts at 8:30? Given slowly and in an informal manner, this aroused much interest and all made attempts at answering and most of the pupils with the help of their

clocks solved it. Then others wanted to "make up" a problem about how they came to school.

Another interesting project was the watching of the construction of the First Baptist Church near the school. One trip was made during school to observe the construction of the steeple. The children made estimates of the heighth which were compared to the actual heighth as secured from the workmen.

Roadmaps and discussion of distances to towns in the county and state were used along with speedometers and other means of measuring distances, and from board drawings of locations of nearby towns, triangles and squares were introduced and problems worked finding the perimeters though only casual reference was made to that fact. It came through the use of illustrated problems such as, "If Bartow is fourteen miles south, Winter Haven twelve miles north east of Bartow, and Lakeland is seventeen miles west of Winter Haven, how far is it from Lakeland to Bartow to Winter Haven and back to Lakeland?

The girls learned to interpret patterns to some extent and measure cloth and cut out garments. The boys and girls measured wood and sawed various objects for craft work.

Scale drawings were used in art work and much use of the ruler was made. Also relay games of sides competing at the board in attempting to follow such directions as "Draw a line two inches long." "Draw a line ten inches long." And later, "Draw a line one-half foot long."

The concept of mass refers to all solids, liquids, and gases. It was presented in concrete form by weights of the pupils, and various things. The relation of an ounce to a pound and a pint to a quart was brought out by actually weighing and measuring and the fractional relations such as one-half, one-fourth and one-third were shown by measuring cups. Practical experience came in preparing frozen citrus concentrate which had to be mixed in proportion of one part concentrate to seven parts of water. This orange juice was prepared and served in the classroom during the warm weather. The number of oranges needed to fill an orange crate was discussed and the facts secured from a packing-house. The relationship between a pint and a quart of strawberries, and the difference in meaning of a pint and a quart of milk were discovered. Thermometers and various gauges used in packing-houses and filling stations were discussed. Why eggs are bought by the dozen, milk by the quart, and butter by the pound was presented and also the importance of weights written on cans of food and loaves of bread. The different forms of water and what was needed to change water to ice or to steam were related to the science study. Some attempt was made to show area by drawing of squares which also proved their findings in multiplication but few were able to follow beyond the simple square.

The concept of value in relationship to money and exchange, though presented last, was really the first concept

needed and used. The first procedure in dealing with each child was through the medium of money. Because he knew and recognized coins the entire program of arithmetic was introduced by having the pupils count real coins, or recognize and name them as he was able. Startling responses were made by some of the money problems. One fourteen year old boy, after strenuous attempts to count the change given him, finally said with a sigh, "Well, I do not know how much money there is on the desk, but if you put a nickel down it will make it a dollar." This statement was correct, but to him $0.95 was unknown. Again while discussing plans for a trip down town to buy supplies, this boy was asked how much money he would give the clerk if he wanted a pencil that cost five cents and some paper that would cost ten cents. He thought about the question and then said: "I wouldn't. I would take it one at a time." Real and play money were used all year intermittently as were buying trips to the store and trips to the Post Office to buy savings stamps. All except three members of the class were working or had worked and knew something of the value of money. Many drills and games were introduced to give practice in counting money. One was when each child would be given a number of play coins and would have to count the total value and write on the board in tabulated form how many of each kind he had. For example, one might write in the spaces arranged, one dollar, three halves, four

quarters, two dimes, and three pennies and record the total sum as $3.73. This required a long time for the calculations but was a class project that each pupil could do if given sufficient time. Also a game used with great success was the "Drive-In-Restaurant" when half of the class became waiters and the other half ordered menus from an elaborate menu written on the board. The waiter had to write out the order, total it and present the bill to the customer who after checking it for correctness gave a bill of large denomination as payment. The waiter had to make the proper change. Another interesting exercise was to write out a grocery list from advertisements in the paper with a definite amount as the limit. Trips were made to the bank and post office and a valid check and Savings Bond were examined. Trips to the City Hall, Telephone Office, Fire Station, and Red Cross Office brought out values received for taxes and values given for those in distress.

Much interest was created by each pupil trying to list each experience he had during one day in which he needed to know numbers or used numbers. Constant reference was made to the greater value received by eating lunch, costing a quarter, in the lunch room, and the habit of eating hamburgers, candy, and pop corn. It seemed to be characteristic of mentally retarded children that they satisfy their immediate desires without any thought of future need. Often pupils would spend their lunch money on candy or buy stamps

and not have lunch money when it was needed. One of the greatest improvements was seen in the appreciation for the value of money and the increased desire to save. It is quite possible that the environmental conditions surrounding these pupils had an important bearing on this lack of theirs at the beginning of the year.

The decimal was introduced only in connection with money and percentage, although some few advanced into long division of decimal numbers and enjoyed it. Much stress was placed on the importance of the decimal in writing 3 to $3.00 or $0.03, as well as the necessity of keeping the decimals in a straight line for addition and subtraction of sums of money. $0.50 was interpreted as 1/2 dollar, $0.25 as 1/4 dollar, and other common fractions were given concretely by cutting up a pie one time and pie plates at other times. The percent as 2% interest was used in connection with War Savings Bonds.

CHAPTER V

EVALUATION

Brownell[1] has pointed out that there is real danger in regarding the findings of any experiment as final, no matter how well it may have been conducted. He suggests that under changed conditions important differences in conclusions might conceivably result. Brueckner[2] following this same thought further states that it is highly desirable for teachers continuously to experiment with the problem of improving teaching by using new ways of enriching the learning experiences of children.

The outcomes of the methods of teaching arithmetic to mentally retarded children cannot be judged by any standard for none exists. According to Dr. Elise Martens of the U. S. Bureau of Education, very little has been done in this field and no methods are available other than some recent curriculum planning by some of the larger city schools in California and New York. Therefore, the evaluation of the effectiveness of the methods used will be considered from two different points of view: first, the evaluation as an integral element of the teaching-learning process that resulted in the educative process, and second, the evaluation of the progress made by the

---

1. W. A. Brownell, Readiness and the Arithmetic Curriculum, p. 495.
2. Leo J. Brueckner, Diagnostic and Remedial Arithmetic, p. 88.

individuals shown by a survey by the use of standardized tests.

Instruction and evaluation cannot be separated. As was reiterated throughout the chapter on methods, inventory and diagnostic tests were used with each change of procedure and method. Three types of evaluation were used in the daily teaching-learning procedure: written tests, informal conversation, and observation. Some description has been given of the methods of testing as inventory and diagnostic findings. Both were used as a methof of evaluation but there was a distinctive difference in the use of each. After an inventory test was given the final score was computed and placed on the individual chart as an indication of rank or score to be improved. In the case of the diagnostic test, no final score was computed, but the work habits of the pupil were evaluated. The evaluation procedure of informal conversation was used in connection with the diagnostic test in allowing the pupil to describe what he was doing as he worked, as well as the repeated use of interpreting the daily happenings as meaningful arithmetic experiences. Observation was used as a factor in diagnostic testing as well as discovering to what extent the pupil was capable of meeting the problems before him.

Featherstone[3] states that more frequent evaluations are

---

3. W. B. Featherstone, Teaching the Slow-Learner, p. 69.

---

3. E. E. Hutchinson, Concerning The Elder-Language: 1. 97.

necessary for the slow learner because they need the emotional security and sense of adequacy and acceptability that comes from the assurance that what they are doing is satisfactory and that their present activities will bring them out in the end where they ought to come out. Also a further need is that they have a tendency to let tomorrow take care of itself and adopt a slip-shod method to get a partial solution and are satisfied with this.

The ideal for the evaluation of outcomes would be for the teacher to be able to say that all the pupils had mastered the fundamentals and had developed adequate concepts of quantitative relationships concerning length, mass, time and value. This, however, is not the case. Evaluation of methods presented went on continually as they were used and because these methods worked most successfully with the majority of the pupils, they were included. From the teacher point of view, there are twenty-two evaluations, for each pupil was a separate case starting at a different place and with a different "expectant quotient." From this point of view every pupil made progress factually as will be shown by the statistical tables in the second evaluation. However, far more important from the writer's standpoint is the progress made in the manifestations of evidences of pupil ability to use and apply numbers in social situations and the blossoming out of these children who for the first time have recognized themselves as persons of worth and ability.

Not only has this personality development been recognizable from the teacher's viewpoint, in the pupils' unanimous demand for "some arithmetic to do," or "some arithmetic to take home to do," but in the judgement of the school nurse, school supervisors and parents, that in some instances the entire expression of the child has changed and his countenance has become radiant because he is experiencing self-realization.

However, the writer is fully aware that these methods will not prove infallible in every case, nor that the findings of this small class in the short time of experimentation can be accepted as conclusive evidence. These methods, which in one case carried the boy with an I. Q. of 68 through the fundamentals and even at his instigation into the processes of square root, merely developed in another the ability to count any groupings of concrete objects, and the ability to count to 100 by ones, fives and tens. One fourteen year old boy who was below the first grade level at the time of admission, and who had such faulty work habits that never during the first months would he finish ten problems at one work period, now at his own wish will finish two and three sets of 100 fundamental problems with an average of 1% error.

The evaluation of the methods or the outcomes of the instructional program can be presented by charts as the results of readiness tests and standard achievement tests but in order to fully understand these a chart of the pupils used for experimentation will be presented.

Experimentation in giving these tests brought to light one definite fact. If the tests were copied on work sheets similar to those used constantly in class work, the results were considerably higher than when presented in the test sheet or booklet form, at which time it was most difficult to get some to even attempt the work. One boy who had made such outstanding progress in personality development, when given the test in booklet form, immediately reverted back to the sullen unresponsive boy who would not attempt any work and muttered to himself over and over that he could not do it. So the results of the tests are lower, on the average, because of this blocking carried over from former unpleasant experiences and associations. If the time element were mentioned or even the suggestion made that all should work as fast as possible, the results were lower than when the test was introduced merely as class work. Also the reading ability of all was very low so the results of the problem tests were unsatisfactory. However, problems were presented in the concrete and that in all probability the mentally retarded child will be called upon to solve problems as they are met verbally or realistically, not in the written form, is recognized.

CHAPTER VI

CONCLUSION

In conclusion it is the opinion of the writer that in dealing with mentally retarded children the following pertinent guiding principles must be followed:

1. The activities must be simple and so planned to be allotted to short periods of time and yet fit into a purposeful pattern.

2. The objectives and plans in each small unit must be very clear and definite.

3. The small units of work must be arranged so as to provide continuity of experience.

4. Meaningful insight must be established by the use of concrete materials and real situations.

5. Drill and more drill in a variety of presentations must be used.

6. Routine drill as such, as the multiplication tables, should never be used.

7. The outcomes and evaluations must be made from a qualitative rather than a quantitative view.

8. The method should enable the child to be successful from the outset of instruction. Materials with which he can succeed should be presented.

9. Instruction must be done individually.

10. One method should be tried systematically, then if it does not succeed, another method should be followed systematically.

11. The use of "crutches" should be allowed until the child leaves them of his own volition.

12. Materials should be presented in such a way that the child can realize he is progressing. A graph of progress or chart is good instruction aid for motivation.

13. The work should at all times be enjoyable.

14. The materials should be interesting to the child, simple enough to secure success, yet sufficiently difficult to stimulate the child to put forth the effort to learn.

BIBLIOGRAPHY

Baker, Harry J., Introduction to Exceptional Children, New York: The Macmillan Company, 1947. P. 484.

Bartky, A. John, "Guidance in Mathematics," Mathematics Teacher, May 1948, Volume XLI Number 5.

Berry, Charles Scott, How the Teacher May Help the Exceptional Child, Athens, Ohio: Ohio University Press, 1938.

Betz, William, "Functional Competence in Mathematics," Mathematics Teacher, May 1948, Volume XLI Number 5.

Blair, Glenn Meyers, Diagnostic and Remedial Teaching in Secondary Schools, New York: The Macmillan Company, 1948. P. 409.

Brueckner, Leo J., Diagnostic and Remedial Arithmetic, Philadelphia: John C. Winston Company, 1930.

Brueckner, Leo J., and Grossnickle, Foster E., How to Make Arithmetic Meaningful, Philadelphia: John C. Winston Company, 1947. P. 506.

Bruner, Herbert B., et. al., What Our Schools Are Teaching, New York: Columbia University Press, 1941.

Butts, R. Freeman, A Cultural History of Education, New York: McGraw-Hill Book Company, Inc., 1947.

Clark, John R., Otis, Arthur S., and Hatton, Carolyn, Primary Arithmetic Through Experience, New York: World Book Company, 1939. P. 213.

Cole, Luella, and Morgan, John J. B., Psychology of Childhood Adolescence, New York: Rhinehart and Company, Inc., 1946. P. 403.

Cooke, Dennis H., "A Usable Philosophy in Teaching Arithmetic," Mathematics Teacher, February 1948, Volume XLI Number 2.

DeGroat, Harry D, and Young, William, Iroquois: New Standard Arithmetic Book I, Iroquois: Iroquois Publishing Company, 1938. P. 455.

Dewey, John, Democracy and Education, New York: The Macmillan Company, 1934. P. 417.

Dewey, John, Intelligence in the Modern World, New York: The Modern Library, Random House, Inc.

Featherstone, W. B., Teaching the Slow Learner, New York: Teacher's College, Columbia University., 1941.

Fernald, Grace M., Remedial Techniques in Basic School Subjects, New York: McGraw-Hill Book Company, Inc. 1943. P. 330.

Florida State Department of Education, Arithmetic in Elementary School, Tallahassee, Florida: Florida State Department of Education Bulletin Number 26, September 1947.

Frasier, George W., and Armentrout, Winfield D., An Introduction to Education, New York: Scott, Foresman and Company, 1927. P. 357.

Greene, Harry A., and Jorgensen, Albert N., The Use and Interpretation of Educational Tests, New York: Longmans, Green and Company, 1929.

Grossnickle, Foster E., "A Laboratory for Meaningful Arithmetic," Mathematics Teacher, March 1948, Volume XLI Number 3.

Heck, Arch O., Education of Exceptional Children, New York: McGraw-Hill Book Company, 1935. P. 517.

Ingram, C. P., Education of the Slow-Learning Child, New York: World Book Company, 1935. P. 419.

Inskeep, Annie D., Teaching Dull and Retarded Children, New York: The Macmillan Company, 1926. P. 455.

Jean-Marc-Gaspard, The Wild Boy of Aveyron, translated by George and Muriel Humphrey, New York: The Century Company, 1932.

Jersild, A. T., Child Psychology, New York: Prentice-Hall, Inc., 1947. P. 566.

Kirk, Samuel A., Teaching Reading to Slow-Learning Children, Boston: Houghton Mifflin Company, 1940. P. 204.

Martens, Elise H., A Guide to Curriculum Adjustment for Mentally Retarded Children, Washington, D. C.: U. S. Government Printing Office, Office of Education, 1936. P. 133.

McIntosh, W. J., "Follow-up Study of One Thousand Non-Academic Boys," Journal of Exceptional Children, March 1949, Volume 15 Number 6.

Morgan, John J. B., The Psychology of the Unadjusted School Child, New York: The Macmillan Company, 1937. P. 339.

Morrison, Henry C., Basic Principles of Education, Boston: Houghton Mifflin Company, 1934. P. 442.

Mossman, Lois Coffey, Teaching and Learning in the Elementary School, Boston: Houghton Mifflin Company, 1929. P. 269.

National Teachers of Mathematics Tenth Yearbook, The Teaching of Arithmetic, New York: Bureau of Publications, Teacher's College, Columbia University, 1935. P. 416.

Norsworthy, Naomi and Whitley, Mary T., The Psychology of Childhood, New York: The Macmillan Company, 1930. P. 343.

Osburn, Worth J., Corrective Arithmetic, Boston: Houghton Mifflin Company, 1924. P. 177.

Reeder, Ward G., A First Course in Education, New York: The Macmillan Company, 1937.

Report of the Harvard Committee, General Education in a Free Society, Cambridge: Harvard University Press, 1945.

Rivlin, Harry N., Educating for Adjustment, New York: D. Appleton Century Company, 1936. P. 409.

Shaffer, L. F., The Psychology of Adjustment, Boston: Houghton Mifflin Company, 1946. P. 600.

Skinner, Charles E., Educational Psychology, New York: Prentice-Hall, Inc., 1945. P. 604.

Slavson, S. R., and Speer, Robert K., Science in the New Education, New York: Prentice-Hall, Inc., 1934. P. 384.

Smith, Walter R., Principles of Educational Sociology, Boston: Houghton Mifflin Company, 1928.

Starch, Daniel, Educational Psychology, New York: The Macmillan Company, 1928.

Thorndike, E. L., The Measurement of Intelligence, New York: Teachers College, Columbia University, 1927. P. 526.

Vaughn, W. F., General Psychology, New York: The Odessy Press, 1939. P. 703.

Wheat, Harry G., "Criteria for Aims in Mathematics," Mathematics Teacher, March 1945, Volume XXXVIII Number 3.

White House Conference on Child Health and Protection, Committee on Special Classes, Section III, "Special Education: The Handicapped and the Gifted," Education and Training, New York: The Century Company, P. 446.

Wilson, Guy M., Stone, Mildred B., and Dalrymple, Charles O., Teaching the New Arithmetic, New York: McGraw-Hill Book Company, Inc., 1939. P. 403.

A P P E N D I X

CHART FOR EXPERIMENTAL CLASS

Standing of Class October 1, 1948

Case	Sex	Age	I. Q. Stanford Binet	I. Q. Wechsler Bellevue	I. Q. Revised Beta	School Grade	Reading Level	Arithmetic Level
1	F	13-3	72	80	68	7	5	4
2	F	15-5	61	62	79	5	4	2
3	F	13-10	72	70	78	6	4	3
4	M	14-3	50	52	59	0	0	0
5	M	14	70	81	82	6	3	3
6	M	13-1	72	70	71	7	0	4
7	M	17	79	55	79	8	5	5
8	M	12	51	54	54	4	0	0
9	F	16-7	78	82	82	7	3	4
10	F	13-1	77	76	77	6	0	2
11	M	12-2	65	65	63	5	3	2
12	F	12-7	87	85	85	6	0	3
13	M	18-5	48	50	35	0	0	0
14	F	11-7	68	68	68	4	2	0
15	M	14-9	62	61	51	0	0	0
16	M	14-5	71	68	70	8	5	4
17	M	16	60	60	62	6	3	3
18	F	16-1	72	70	62	0	2	0
19	M	15-3	65	65	65	8	5	5
20	M	13-10	62	73	58	7	4	4
21	M	14-2	60	55	53	6	0	1
22	M	16-9	36	41	35	0	0	0

Achievement Test Results made in April, 1949

Case	Sex	Age	Reading Level	Arithmetic Level	METROPOLITAN Fundamentals	METROPOLITAN Problems	METROPOLITAN Average	BRUECKNER Fundamentals	BRUECKNER Problems	BRUECKNER Average
1	F	13-3	5	4	6^{1}	5^{5}	5^{8}	4^{4}	5^{4}	4^{9}
2	F	15-5	4	2	4	3^{2}	3^{6}	3^{8}	3^{2}	3^{5}
3	F	13-10	4	3	4^{6}	5^{2}	4^{9}	3^{2}	3^{8}	3^{5}
4	M	14-3	0	0	2^{8}	0	1^{4}	2	0	1
5	M	14	3	3	3^{5}	3	$3^{2.5}$	3^{6}	3^{4}	3^{5}
6	M	13-1	0	4	5^{3}	3^{9}	4^{6}	4^{9}	3^{6}	$4^{2.5}$
7	M	17	5	5	5	5^{1}	$5^{0.5}$	5^{8}	5^{2}	5^{5}
8	M	12	0	0	3^{4}	2^{5}	$2^{9.5}$	3^{2}	2	2^{6}
9	F	16-7	3	4	5^{3}	3^{7}	4^{5}	4^{4}	3^{6}	4
10	F	13	0	2	4^{6}	3^{8}	4^{2}	3^{1}	2^{7}	2^{9}
11	M	12	3	2	3^{9}	3^{7}	3^{8}	3^{4}	3^{2}	3^{3}
12	F	12-7	0	3	4^{3}	3^{8}	$4^{0.5}$	4^{3}	3^{7}	4
13	M	18-5	0	0	2	0	1	2^{1}	0	$1^{0.5}$
14	F	11-7	2	0	2^{3}	0	$1^{1.5}$	2^{4}	0	1^{2}
15	M	14-9	0	0	3^{1}	2^{5}	2^{8}	3	2^{4}	2^{7}
16	M	14-5	5	4	6^{2}	4^{9}	$5^{5.5}$	4^{6}	4^{8}	4^{7}
17	M	16	3	3	4^{5}	3^{9}	4^{2}	3^{1}	3^{5}	3^{3}
18	F	16-1	2	0	3^{2}	1	2^{1}	3	0	1^{5}
19	M	15-3	5	5	5^{5}	4^{9}	5^{2}	5^{8}	5^{2}	5^{5}
20	M	13-10	4	4	5	5	5	4^{6}	4^{4}	4^{5}
21	M	14-2	0	1	4	2	3	3^{6}	2^{2}	2^{9}
22	M	16-9	0	0	0	0	0	0	0	0

Metropolitan Achievement Tests, Primary Form III A Revised
Metropolitan Achievement Tests, Intermediate Partial A
Unit Scales of Attainment Division 2, Form A, developed by
L. J. Brueckner and M. J. Van Wagenen.